4.0 Field Investigations

This remedial investigation will consist of a five-phase approach. The investigation phases are as follows:

- XRF survey of surface soil to determine soil borings and sample locations for surface soil only.
- Install a total of 15 soil borings and collect one surface soil sample and two discrete subsurface soil samples from each soil boring (15 surface soil samples and 30 subsurface soil samples).
- Collect five surface soil samples from five locations to be determined based on XRF surface soil screening results.
- Collect groundwater samples from four pre-existing monitoring wells.
- Collect seven surface water and seven sediment samples.

XRF surface soil screening will be carried out in situ at approximately 80 locations within a grid installed in the area of investigation at Parcel 137Q-X, as shown on Figure 4-1. Samples for XRF screening will be collected at the grid line intersections or "grid nodes" and are listed on Table 4-1. Additional XRF screening locations will be selected in the area of SI investigation not covered by the grid to screen for "hot spots." The purpose of the XRF surface soil screening will be to screen the surface soils for lead contamination in the area of SI sample locations HR-137Q-MW03 (DP), HR-137Q-MW04, HR-137Q-GP04, and HR-137Q-DEP01. Soil boring locations and surface soil sample locations will be selected using the XRF surface soil screening results to collect samples for analysis to define the horizontal extent of the presence of lead.

A total of 15 soil borings will be installed at Parcel 137Q-X to provide data to determine the vertical and horizontal extent of potential metals contamination in soil. A total of 15 surface soil samples and 30 subsurface soil samples will be collected from the soil borings. In addition, surface soil samples only will be collected at five surface soil sample locations. Five of the 15 soil boring locations have been selected and are shown on Figure 4-2. XRF surface soil screening data may be used to adjust the final locations of these selected soil borings. The ten remaining soil boring locations and the five surface soil only locations will be selected based on results of XRF surface soil screening data and field conditions. One surface soil and two discrete subsurface soil samples will be collected from each of the 15 soil borings (a total of 15 surface soil samples and 30 subsurface soil samples). The selection of the intervals for the discrete

STARTING DATE: 12/16/02 | DATE LAST REV.: | DRAFT. CHCK. BY: | INITIATOR: J. RAGSDALE | DWG. NO.: 796887es643
DRAWN BY: D. BOMAR | DRAWN BY: | ENGR. CHCK. BY: S. MORAN | PROJ. MGR.: J. YACOUB | PROJ. NO.: 796887

E 684,600

E 686,900

N 1,181,800

N 1,179,700

MAIN POST BOUNDARY

PARCEL 137Q-X
1143 ACRES

HR-137Q-DEP06
HR-137Q-GP01
HR-137Q-DEP01
HR-137Q-GP02
HR-137Q-GP05
HR-137Q-GP03
HR-137Q-DEP03
HR-137Q-DEP05
HR-137Q-MW03
HR-137Q-MW02
HR-137Q-MW03(DP)
HR-137Q-GP08
HR-137Q-GP04
HR-137Q-GP11
HR-137Q-GP10
HR-137Q-GP06
HR-137Q-MW01
HR-137Q-MW04
HR-137Q-GP07
HR-137Q-DEP04
HR-137Q-GP09
HR-137Q-DEP02

N500 N400 N300 N200 N100 0 S100 S200 S300 S400 S500
W700 W600 W500 W400 W300 W200 W100 0 E100 E200 E300 E400 E500 E600

FLOW

LEGEND

- UNIMPROVED ROADS AND PARKING
- PAVED ROADS AND PARKING
- BUILDING
- TOPOGRAPHIC CONTOURS (CONTOUR INTERVAL - 25 FOOT)
- TREES / TREELINE
- AREA OF INVESTIGATION
- SURFACE DRAINAGE / CREEK
- TRENCH WITH NUMEROUS SURFACE DEPRESSIONS THROUGHOUT
- SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION
- MONITORING WELL / GROUNDWATER, SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION
- DEPOSITIONAL SOIL SAMPLE LOCATION
- XRF SAMPLE LOCATION GRID (100 ft x 100 ft) LOCATION HR-137Q-MW03 EQUALS GRID NODE 0,N100. XRF SURFACE SOIL SAMPLE WILL BE COLLECTED AT EACH GRID NODE.

NOTE:

1. GRID NODES ARE LABELED BY DISTANCE AND DIRECTION FROM CENTER POINT OF GRID (e.g., N100, W100) AND WILL BE LOCATED BY ACTUAL COORDINATES OF THE U.S. STATE PLANE COORDINATE SYSTEM, ALABAMA EAST ZONE, NORTH AMERICAN DATUM OF 1983.

SCALE
0 150 300 FEET

FIGURE 4-1
XRF SAMPLE LOCATION MAP
FORMER 81mm MORTAR RANGE
PARCEL 137Q-X

U. S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT
FORT McCLELLAN
CALHOUN COUNTY, ALABAMA
Contract No. DACA21-96-D-0018

IT CORPORATION
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Table 4-1

XRF Grid Node Coordinates
Former 81mm Mortar Range, Parcel 137Q-X
Fort McClellan, Calhoun County, Alabama

Grid Node	Northing	Easting
0, 0	**1180585.22**	**685394.55**
N100, 0	1180685.22	685394.55
N200, 0	1180785.22	685394.55
N300, 0	1180885.22	685394.55
N400, 0	1180985.22	685394.55
N500, 0	1181085.22	685394.55
S100, 0	1180485.22	685394.55
S200, 0	1180385.22	685394.55
S300, 0	1180285.22	685394.55
S400, 0	1180185.22	685394.55
S500, 0	1180085.22	685394.55
0, E100	1180585.22	685494.55
N100, E100	1180685.22	685494.55
N200, E100	1180785.22	685494.55
N300, E100	1180885.22	685494.55
N400, E100	1180985.22	685494.55
N500, E100	1181085.22	685494.55
S100, E100	1180485.22	685494.55
S200, E100	1180385.22	685494.55
S300, E100	1180285.22	685494.55
S400, E100	1180185.22	685494.55
S500, E100	1180085.22	685494.55
0, W100	1180585.22	685294.55
N100, W100	1180685.22	685294.55
N200, W100	1180785.22	685294.55
N300, W100	1180885.22	685294.55
N400, W100	1180985.22	685294.55
N500, W100	1181085.22	685294.55
S100, W100	1180485.22	685294.55
S200, W100	1180385.22	685294.55
S300, W100	1180285.22	685294.55
S400, W100	1180185.22	685294.55
S500, W100	1180085.22	685294.55
0, E200	1180585.22	685594.55
N100, E200	1180685.22	685594.55
N200, E200	1180785.22	685594.55
N300, E200	1180885.22	685594.55
N400, E200	1180985.22	685594.55
N500, E200	1181085.22	685594.55
S100, E200	1180485.22	685594.55
S200, E200	1180385.22	685594.55
S300, E200	1180285.22	685594.55
S400, E200	1180185.22	685594.55
S500, E200	1180085.22	685594.55

Table 4-1

XRF Grid Node Coordinates
Former 81mm Mortar Range, Parcel 137Q-X
Fort McClellan, Calhoun County, Alabama

Grid Node	Northing	Easting
0, W200	1180585.22	685194.55
N100, W200	1180685.22	685194.55
N200, W200	1180785.22	685194.55
N300, W200	1180885.22	685194.55
N400, W200	1180985.22	685194.55
N500, W200	1181085.22	685194.55
S100, W200	1180485.22	685194.55
S200, W200	1180385.22	685194.55
S300, W200	1180285.22	685194.55
S400, W200	1180185.22	685194.55
S500, W200	1180085.22	685194.55
0, E300	1180585.22	685694.55
N100, E300	1180685.22	685694.55
N200, E300	1180785.22	685694.55
N300, E300	1180885.22	685694.55
N400, E300	1180985.22	685694.55
N500, E300	1181085.22	685694.55
S100, E300	1180485.22	685694.55
S200, E300	1180385.22	685694.55
S300, E300	1180285.22	685694.55
S400, E300	1180185.22	685694.55
S500, E300	1180085.22	685694.55
0, W300	1180585.22	685094.55
N100, W300	1180685.22	685094.55
N200, W300	1180785.22	685094.55
N300, W300	1180885.22	685094.55
N400, W300	1180985.22	685094.55
N500, W300	1181085.22	685094.55
S100, W300	1180485.22	685094.55
S200, W300	1180385.22	685094.55
S300, W300	1180285.22	685094.55
S400, W300	1180185.22	685094.55
S500, W300	1180085.22	685094.55
0, E400	1180585.22	685794.55
N100, E400	1180685.22	685794.55
S100, E400	1180485.22	685794.55
S200, E400	1180385.22	685794.55
S300, E400	1180285.22	685794.55
0, W400	1180585.22	684994.55
N100, W400	1180685.22	684994.55
N200, W400	1180785.22	684994.55
N300, W400	1180885.22	684994.55
N400, W400	1180985.22	684994.55
N500, W400	1181085.22	684994.55
S100, W400	1180485.22	684994.55

Table 4-1

XRF Grid Node Coordinates
Former 81mm Mortar Range, Parcel 137Q-X
Fort McClellan, Calhoun County, Alabama

Grid Node	Northing	Easting
0, E500	1180585.22	685894.55
N100, E500	1180685.22	685894.55
S100, E500	1180485.22	685894.55
S200, E500	1180385.22	685894.55
0, W500	1180585.22	684894.55
N100, W500	1180685.22	684894.55
N 200, W500	1180785.22	684894.55
N 300, W500	1180885.22	684894.55
N 400, W500	1180985.22	684894.55
N 500, W500	1181085.22	684894.55
S100, W500	1180485.22	684894.55
0, E600	1180585.22	685994.55
N100, E600	1180685.22	685994.55
S100, E600	1180485.22	685994.55
S200, E600	1180385.22	685994.55
N 200, W600	1180785.22	684794.55
N 300, W600	1180885.22	684794.55
N 400, W600	1180985.22	684794.55
N 500, W600	1181085.22	684794.55
N200, W700	1180785.22	684694.55
N300, W700	1180885.22	684694.55
N400, W700	1180985.22	684694.55
N500, W700	1181085.22	684694.55

STARTING DATE: 12/16/02 | DATE LAST REV.: | DRAFT. CHCK. BY: | INITIATOR: J. RAGSDALE | DWG. NO.: 796887es644
DRAWN BY: D. BOMAR | DRAWN BY: | ENGR. CHCK. BY: S. MORAN | PROJ. MGR.: J. YACOUB | PROJ. NO.: 796887

E 684,600

E 686,900

N 1,181,800

N 1,179,700

MAIN POST BOUNDARY

PARCEL 137Q-X
1143 ACRES

HR-137Q-SW/SD04
HR-137Q-SW/SD03
HR-137Q-SW/SD05
HR-137Q-SW/SD07
HR-137Q-GP16
HR-137Q-GP15
HR-137Q-MW03
HR-137Q-GP12
HR-137Q-MW03(DP)
HR-137Q-SW/SD06
HR-137Q-MW02
HR-137Q-SW/SD02
HR-137Q-GP04
HR-137Q-GP13
HR-137Q-MW04
HR-137Q-MW01
HR-137Q-GP14
HR-137Q-SW/SD01

FLOW

LEGEND

- UNIMPROVED ROADS AND PARKING
- PAVED ROADS AND PARKING
- BUILDING
- TOPOGRAPHIC CONTOURS (CONTOUR INTERVAL - 25 FOOT)
- TREES / TREELINE
- AREA OF INVESTIGATION
- SURFACE DRAINAGE / CREEK
- TRENCH WITH NUMEROUS SURFACE DEPRESSIONS THROUGHOUT
- EXISTING SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION
- EXISTING RESIDUUM MONITORING WELL LOCATION TO BE RESAMPLED
- PROPOSED SURFACE WATER/SEDIMENT SAMPLE LOCATION
- PROPOSED SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION

APPROXIMATE LOCATION OF OBSERVED FEATURES

1. OLD RUSTED TRUCK WITH BULLET HOLES
2. TRENCH WITH EMPTY RUSTED STB DRUMS (3), POSSIBLE METAL SHOWER HEAD, AND ONE FOXHOLE
3. SEVERAL RUSTED 1-5 GALLON DRUMS (POSSIBLE GAS CANS AND STB DRUMS), SHOWER HEADS, AND THE BACK OF AN OLD TRUCK
4. 2 SURFACE DEPRESSIONS
5. SURFACE DEPRESSION WITH RUSTED METAL SHEET IN BOTTOM (APPEARS TO BE WALLS OF OLD TUB)
6. DISTURBED AREA
7. OLD ROAD RUNNING PARALLEL TO SECONDARY ROAD
8. 4 RUSTED DRUMS (SOME ARE CONSTRUCTED OF CORRUGATED STEEL) IN DIRT MOUND
9. RUSTED DRUM WEST OF DIRT MOUND
10. OLD RUSTED TRUCK BED AND DISTURBED AREA WITH MOUNDS AND DEPRESSIONS
11. PIT IN TRENCH WITH METAL IN BOTTOM

SCALE
0 150 300 FEET

NOTE:

1. APPROXIMATELY 10 ADDITIONAL SOIL BORINGS AND 5 ADDITIONAL SURFACE SOIL SAMPLE LOCATIONS (NOT SHOWN) WILL BE INSTALLED BASED ON XRF SOIL SCREENING RESULTS.

FIGURE 4-2
PROPOSED SAMPLE LOCATION MAP
FORMER 81mm MORTAR RANGE
PARCEL 137Q-X

U. S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT
FORT McCLELLAN
CALHOUN COUNTY, ALABAMA
Contract No. DACA21-96-D-0018

IT CORPORATION
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subsurface samples will be based on XRF screening of the subsurface soil showing the highest lead concentrations.

Four groundwater samples will be collected from the existing monitoring wells in the vicinity of Parcel 137Q-X. Existing residuum monitoring wells are shown on Figure 4-2. Groundwater sample data will provide information on flow direction and water quality in the residuum saturated zone.

Seven surface water and seven sediment samples will be collected from intermittent stream locations at Parcel 137Q-X, as shown on Figure 4-2.

The following sections describe the field activities required to conduct the remedial investigations at Parcel 137Q-X.

4.1 UXO Survey Requirements and Utility Clearances

Parcel 137Q-X falls within the "Possible Explosive Ordnance Impact Areas" shown on Plate 10 of the ASR (USACE, 2001); therefore, UXO surface sweeps and downhole surveys of soil borings will be required to support field activities this site. The surface sweeps and downhole surveys will be conducted to identify anomalies for the purposes of UXO avoidance. IT will conduct UXO avoidance activities as outlined in Appendix E of the SAP (IT, 2002a) and the attached site-specific UXO safety plan.

4.1.1 Surface UXO Survey

A UXO sweep will be conducted over areas that will be included in the sampling and surveying activities to identify UXO on or near the surface that may present a hazard to on-site workers during field activities. Low-sensitivity magnetometers will be used to locate surface and shallow-buried metal objects. UXO located on the surface will be identified and conspicuously marked for easy avoidance. UXO personnel requirements, procedures, and detailed descriptions of the geophysical equipment to be used are provided in Chapter 4.0 and Appendix E of the SAP (IT, 2002a).

4.1.2 Downhole UXO Survey

During the soil boring and downhole sampling activities, a downhole UXO survey will be performed to determine if buried metallic objects are present. UXO monitoring as described in Appendix E of the SAP (IT, 2002a) will continue until undisturbed soils are encountered or the borehole has been advanced to 12 feet bgs, whichever is reached first.

4.1.3 Utility Clearances

After the UXO surface survey has cleared the area to be sampled and prior to performing any intrusive sampling, a utility clearance will be performed at all locations where soil and groundwater samples will be collected, using the procedure outlined in Section 4.2 of the SAP (IT, 2002a). The site manager will mark the proposed locations with stakes, coordinate with the appropriate utility companies to clear the proposed locations for utilities, and obtain digging permits. Once the locations are approved (for both UXO and utility avoidance) for intrusive sampling, the stakes will be labeled as cleared.

4.2 X-Ray Fluorescence Surface Soil Screening

XRF surface soil screening will be carried out in situ at approximately 80 locations within a grid installed at the area of investigation of the Former 81mm Mortar Range, Parcel 137Q-X, shown on Figure 4-1. Additional XRF screening locations will be selected at random in the area of investigation outside the grid to screen for "hot spots." The purpose of the XRF surface soil screening will be to screen the surface soils in the area of investigation to define the horizontal extent of the presence of lead. The 100-foot grid shown in Figure 4-1 presents the proposed XRF surface soil sample locations surrounding sample locations HR-137Q-MW03 (DP), HR-137Q-MW04, HR-137Q-GP04, and HR-137Q-DEP01. Samples will be collected at the grid line intersections or "grid nodes." Table 4-1 presents the coordinates for each grid node where surface soil will be collected for XRF screening. The limits of the grid were determined by reviewing the laboratory results of samples collected during the previous SI by IT that is presented in Chapter 2.0 of this SFSP. XRF surface soil screening results will be compared to the ESV for lead (50 mg/kg) to determine the actual limits of the grid boundaries. The XRF grid may be expanded if surface soil results at grid nodes along the perimeter of the grid indicate high levels of lead. After the initial XRF screening of surface soil at each grid node has been completed, additional sample locations between grid nodes may be selected for XRF screening to further define the extent of lead contamination. Results from the XRF surface soil screening will be used to aid in placing soil boring locations and surface soil sample locations and may be used to adjust the sample locations shown on Figure 4-2 and presented in Table 4-2.

The XRF surface soil screening will be carried out in accordance with the procedures specified in Section 6.9 of the SAP. Sample documentation and chain of custody (COC) will be recorded as specified in Chapter 6.0 of the SAP.

To perform this phase of the investigation, metals analysis will be completed on site using an energy-dispersive portable XRF instrument. Site surface soil areas will be prepared and analyzed in situ according to the methodology specified in this SFSP. Although the XRF

Table 4-2

Sampling Locations and Rationale
Remedial Investigation
Former 81mm Mortar Range , Parcel 137Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Media	Sample Location Rationale
HR-137Q-MW01	One groundwater	Resample pre-existing permanent residuum monitoring well. Groundwater sample will be collected from existing monitoring well to provide sample data to assist in characterizing the groundwater for potential contamination and to provide sample data to support RI.
HR-137Q-MW02	One groundwater	Resample pre-existing permanent residuum monitoring well. Groundwater sample will be collected from existing monitoring well to provide sample data to assist in characterizing the groundwater for potential contamination and to provide sample data to support RI.
HR-137Q-MW03	One groundwater	Resample pre-existing permanent residuum monitoring well. Well was dry at the time of last sampling. However, after increased fall and winter rainfall, the well may have available groundwater for sampling. Groundwater sample will be collected from existing monitoring well to provide sample data to assist in characterizing the groundwater for potential contamination and to provide sample data to support RI.
HR-137Q-MW04	One groundwater	Resample pre-existing permanent residuum monitoring well. Groundwater sample will be collected from existing monitoring well to provide sample data to assist in characterizing the groundwater for potential contamination and to provide sample data to support RI.
HR-137Q-GP12	One surface soil and two subsurface soils	Soil boring for one surface soil and two subsurface soil samples to be located downslope and immediately adjacent to HR-137Q-MW03(DP). Sample data will indicate if contaminant releases into the environment have occurred from the use of this area and if contaminated media exists at this site. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentrations. The monitoring well location will be used to establish a local groundwater flow direction, site-specific geology and provide information on groundwater quality in the residuum aquifer. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-137Q-GP13	One surface soil and two subsurface soils	Soil boring location for one surface soil and two subsurface soil samples to be located immediately adjacent to HR-137Q-MW04. Sample data will indicate if contaminant releases into the environment have occurred from the use of this area and if contaminated media exists at this site. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentrations. The monitoring well location will be used to establish a local groundwater flow direction, site-specific geology and provide information on groundwater quality in the residuum aquifer. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-137Q-GP14	One surface soil and two subsurface soils	Soil boring location for one surface soil and two subsurface soil samples to be located immediately adjacent to HR-137Q-GP04. Sample data will confirm contaminant results previously found in samples for location HR-137Q-GP04. First subsurface soil sample to be collected 1 to 2 feet below ground surface (bgs) to match subsurface depth at location HR-137Q-GP04. Second subsurface soil sample to be collected from the interval between first subsurface soil sample and 12 feet bgs showing the highest concentration determined by XRF screening. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-137Q-GP15	One surface soil and two subsurface soils	Soil boring location for one surface soil and two subsurface soil samples to be located approximately 100 east of HR-137Q-SB01 at grid node W200, N200. Sample data will confirm contaminant results previously found in this area for HR-137Q-SB01 and HR-137Q-GP03 . Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentrations. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-137Q-GP16	One surface soil and two subsurface soils	Soil boring location for one surface soil and two subsurface soil samples to be located outside the western boundary of the area of investigation at grid node W600, N300. Sample data will indicate if contaminant releases into the environment have occurred from the use of this area and if contaminated media exists at this site. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentrations. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.

Table 4-2

Sampling Locations and Rationale
Remedial Investigation
Former 81mm Mortar Range , Parcel 137Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Media	Sample Location Rationale
HR-137Q-GP17	One surface soil and two subsurface soils	Soil boring location for one surface soil and two subsurface soil samples to be determined from XRF screening results. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentrations. Sample data will be used to determine vertical and horizontal extent of potential contamination at the parcel to support the RI. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-137Q-GP18	One surface soil and two subsurface soils	Soil boring location for one surface soil and two subsurface soil samples to be determined from XRF screening results. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentrations. Sample data will be used to determine vertical and horizontal extent of potential contamination at the parcel to support the RI. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-137Q-GP19	One surface soil and two subsurface soils	Soil boring location for one surface soil and two subsurface soil samples to be determined from XRF screening results. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentrations. Sample data will be used to determine vertical and horizontal extent of potential contamination at the parcel to support the RI. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-137Q-GP20	One surface soil and two subsurface soils	Soil boring location for one surface soil and two subsurface soil samples to be determined. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentrations. Sample data will be used to determine vertical and horizontal extent of potential contamination at the parcel to support the RI. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-137Q-GP21	One surface soil and two subsurface soils	Soil boring location for one surface soil and two subsurface soil samples to be determined. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentrations. Sample data will be used to determine vertical and horizontal extent of potential contamination at the parcel to support the RI. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-137Q-GP22	One surface soil and two subsurface soils	Soil boring location for one surface soil and two subsurface soil samples to be determined. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentrations. Sample data will be used to determine vertical and horizontal extent of potential contamination at the parcel to support the RI. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-137Q-GP23	One surface soil and two subsurface soils	Soil boring location for one surface soil and two subsurface soil samples to be determined. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentrations. Sample data will be used to determine vertical and horizontal extent of potential contamination at the parcel to support the RI. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-137Q-GP24	One surface soil and two subsurface soils	Soil boring location for one surface soil and two subsurface soil samples to be determined. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentrations. Sample data will be used to determine vertical and horizontal extent of potential contamination at the parcel to support the RI. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-137Q-GP25	One surface soil and two subsurface soils	Soil boring location for one surface soil and two subsurface soil samples to be determined. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentrations. Sample data will be used to determine vertical and horizontal extent of potential contamination at the parcel to support the RI. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.

Table 4-2

Sampling Locations and Rationale
Remedial Investigation
Former 81mm Mortar Range , Parcel 137Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Media	Sample Location Rationale
HR-137Q-GP26	One surface soil and two subsurface soils	Soil boring location for one surface soil and two subsurface soil samples to be determined. Two discrete subsurface soil samples will be collected from 1 to 12 feet bgs based on XRF screening showing the highest lead concentrations. Sample data will be used to determine vertical and horizontal extent of potential contamination at the parcel to support the RI. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-137Q-GP27	One surface soil	One surface soil sample location to be collected from 0 to 1 foot bgs determined from XRF screening results from grid samples. Sample data will be used to determine horizontal extent of potential contamination at the parcel to support the RI. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-137Q-GP28	One surface soil	One surface soil sample location to be collected from 0 to 1 foot bgs determined from XRF screening results from grid samples. Sample data will be used to determine horizontal extent of potential contamination at the parcel to support the RI. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-137Q-GP29	One surface soil	One surface soil sample location to be collected from 0 to 1 foot bgs determined from XRF screening results from grid samples. Sample data will be used to determine horizontal extent of potential contamination at the parcel to support the RI. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-137Q-GP30	One surface soil	One surface soil sample location to be collected from 0 to 1 foot bgs determined from XRF screening results from grid samples. Sample data will be used to determine horizontal extent of potential contamination at the parcel to support the RI. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-137Q-GP31	One surface soil	One surface soil sample location to be collected from 0 to 1 foot bgs determined from XRF screening results from grid samples. Sample data will be used to determine horizontal extent of potential contamination at the parcel to support the RI. Soil sample data will also be used to assess potential impacts to terrestrial biota that might utilize the site for food and/or habitat purposes.
HR-137Q-SW/SD01	Surface water and sediment	The sample location is in the eastern intermittent stream that flows north at the southern boundary of the area of investigation for Parcel 137Q-X . Sample data will indicate if contaminant releases have occurred from runoff up stream of this area from former activities outside this area. Sample data will also be used to assess potential impacts to aquatic biota in the waterway and other ecological receptors that may utilize the waterway for food and/or habitat purposes.
HR-137Q-SW/SD02	Surface water and sediment	The sample location is in the eastern intermittent stream that flows north in the central portion of the area of investigation for Parcel 137Q-X. Sample data will indicate if contaminant releases have occurred from runoff from former activities in this area. Sample data will also be used to assess potential impacts to aquatic biota in the waterway and other ecological receptors that may utilize the waterway for food and/or habitat purposes.
HR-137Q-SW/SD03	Surface water and sediment	The sample location is in the eastern intermittent stream that flows north in the northern portion of the area of investigation for Parcel 137Q-X. Sample data will indicate if contaminant releases have occurred from runoff from former activities in this area. Sample data will also be used to assess potential impacts to aquatic biota in the waterway and other ecological receptors that may utilize the waterway for food and/or habitat purposes.
HR-137Q-SW/SD04	Surface water and sediment	The sample location is in the intermittent stream that flows north, and just downstream of the confluence of the two streams that flow north through most of the area of investigation for Parcel 137Q-X . Sample data will indicate if contaminant releases have occurred from runoff from former activities in most of the area of investigation. Sample data will also be used to assess potential impacts to aquatic biota in the waterway and other ecological receptors that may utilize the waterway for food and/or habitat purposes.

Table 4-2

Sampling Locations and Rationale
Remedial Investigation
Former 81mm Mortar Range , Parcel 137Q-X
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Media	Sample Location Rationale
HR-137Q-SW/SD05	Surface water and sediment	The sample location is in the western intermittent stream that flows north in the north portion of the area of investigation for Parcel 137Q-X. Sample data will indicate if contaminant releases have occurred from runoff from former activities in this area. Sample data will also be used to assess potential impacts to aquatic biota in the waterway and other ecological receptors that may utilize the waterway for food and/or habitat purposes.
HR-137Q-SW/SD06	Surface water and sediment	The sample location is in the western intermittent stream that flows north in the central portion of the area of investigation for Parcel 137Q-X. Sample data will indicate if contaminant releases have occurred from runoff from former activities in this area. Sample data will also be used to assess potential impacts to aquatic biota in the waterway and other ecological receptors that may utilize the waterway for food and/or habitat purposes.
HR-137Q-SW/SD07	Surface water and sediment	The sample location is in the intermittent stream that flows northwest, outside the western boundary of the northwestern area of Parcel 137Q-X. Sample data will indicate if contaminant releases have occurred from runoff in this area from former activities in this area. Sample data will also be used to assess potential impacts to aquatic biota in the waterway and other ecological receptors that may utilize the waterway for food and/or habitat purposes.

instrument will measure and record a number of metals present at the screening location, lead has been selected as the primary indicator element of contamination from range use. XRF surface soil analysis provides screening-level data.

XRF surface soil screening measurements involve exposing the soil to a series of x-rays generated by radioactive sources stored within the instrument. Qualitative and quantitative data are generated by measuring the wavelength and frequency of the fluorescence of the metallic elements present in the soil. The fluorescence is a function of the x-ray strength and length of exposure during analysis. These data are captured and interpreted using an onboard data processor, then reported via the display screen for manual recording in terms of concentration and standard deviation. The manufacturer's directions for instrument calibration, operation, and maintenance shall be followed explicitly. Select samples will be measured in duplicate to assess analytical precision.

Prior to the measurement, the analyst will perform the daily instrument calibration checks. In situ measurements will be conducted by the XRF analyst placing the instrument probe in direct contact with the soil. In situ measurements will be performed on areas where the soil has been prepared. This preparation will include the following steps:

- A visual assessment to ensure the soil is not wet (if the location is wet, an aliquot will be collected and prepared by oven drying in a mobile lab to remove moisture before analysis)
- Removal of rocks, vegetative material, and bullet fragments from the surface using a trowel or spoon.
- Thorough surficial mixing to break up the compacted soil
- Hand tamping the soil into a small, compacted dome with a level surface for probe interface.

When a compacted, level surface is achieved, the probe is then placed onto the prepared surface and is checked for consistency of contact and the analysis initiated. When the measurement is complete, the analyst will record the XRF surface soil sample result manually on the XRF surface soil sample collection log. The XRF instrument logger will also record the analytical result associated with the sample location identity in its internal memory. This process will be repeated to gather data for all identified locations.

During XRF calibration, the analyst will perform measurements on a blank matrix (Teflon® or quartz) and on two standard reference materials (SRM) purchased from the National Institute of

Standards and Technology. SRM 2586 has a certified concentration of 432 mg/kg of lead, and SRM 2711 has a certified concentration of 1,162 mg/kg of copper. Successful calibration of the instrument will be based on a nondetect value for lead on the blank matrix sample while achieving a relative percent difference of less than 25 percent for the SRM-measured concentrations compared to their certified values for lead and copper. Calibrations will be performed at the beginning and end of each day's analysis.

In addition to the accuracy check of the calibration, the XRF instrument will be used to periodically measure the same location in duplicate to assess analytical precision. The check will be performed once every 20 field measurements at the discretion of the XRF analyst.

XRF QA/QC surface soil samples will be collected and submitted for laboratory analysis by EPA Method 6010B for lead. If the XRF instrument indicates locations with a high concentration of lead, the XRF QA/QC surface soil samples will be collected from these locations. The XRF QA/QC surface soil samples will be collected at a frequency of 10 percent. Therefore, of approximately 80 surface soil sample locations proposed, there will be eight laboratory XRF QA/QC surface soil samples collected. The number of actual XRF QA/QC surface soil samples will be determined on the actual number of surface soil samples screened by XRF. The XRF QA/QC samples, as listed in Table 4-3 of this SFSP, will be analyzed in the laboratory for lead and copper using the method presented in Section 4.6.

The XRF analyst will be responsible for manually recording the results of the instrument calibration and the results of each field measurement using the XRF calibration forms and the XRF surface soil sample collection form.

4.3 Environmental Sampling

The environmental sampling program during the RI for the Former 81mm Mortar Range, Parcel 137Q-X, includes the collection of surface and subsurface soil, groundwater, surface water, and sediment samples for chemical analyses. The proposed sampling is intended to provide sufficient data to complete the RI; however, if additional contaminants are detected, additional phases of groundwater monitoring well installation and sampling may be required.

4.3.1 Surface Soil Sampling

Twenty surface soil samples will be collected at 15 soil boring locations and from five surface soil locations at Parcel 137Q-X.

Table 4-3

XRF QA/QC Surface Soil Sample Designations and QA/QC Sample Quantities,
Former 81mm Mortar Range, Parcel 137Q-X
Fort McClellan, Alabama

Sample Location	Sample Designation	Sample Depth (feet)	QA/QC Samples		Analytical Suite
			Field Duplicates	MS/MSD	
HR-137Q-####	HR-137Q-####-SS-RH$$$$-REG	0-1	HR-137Q-####-SS-RH$$$$-FD		Lead and Copper
HR-137Q-####	HR-137Q-####-SS-RH$$$$-REG	0-1			Lead and Copper
HR-137Q-####	HR-137Q-####-SS-RH$$$$-REG	0-1		HR-137Q-####-SS-RH$$$$-MS/MSD	Lead and Copper
HR-137Q-####	HR-137Q-####-SS-RH$$$$-REG	0-1			Lead and Copper
HR-137Q-####	HR-137Q-####-SS-RH$$$$-REG	0-1			Lead and Copper
HR-137Q-####	HR-137Q-####-SS-RH$$$$-REG	0-1			Lead and Copper
HR-137Q-####	HR-137Q-####-SS-RH$$$$-REG	0-1			Lead and Copper
HR-137Q-####	HR-137Q-####-SS-RH$$$$-REG	0-1			Lead and Copper

- Unique location identifier
$$$$ - Unique sample number
FD - Field duplicate.
MS/MSD - Matrix spike/matrix spike duplicate.
QA/QC - Quality assurance/quality control.
REG - Field sample.

4.3.1.1 Sample Locations and Rationale

The sampling rationale for each surface soil sample is listed in Table 4-2. Five of the 15 soil boring locations where surface soil samples will be collected have been selected and are shown on Figure 4-2. The remaining ten soil boring locations and the five surface soil sample locations will be determined based on results from XRF surface soil screening for lead. Surface soil sample designations and QA/QC sample requirements are summarized in Table 4-4. The final soil boring locations and the surface soil sample locations will be determined in the field by the on-site geologist based on actual field conditions.

4.3.1.2 Sample Collection

Surface soil samples will be collected from the uppermost foot of soil by direct-push methodology as specified in Sections 5.1.1.1 and 6.1.1.1 of the SAP (IT, 2002a). In areas where site access does not permit the use of a direct-push rig, the samples will be collected using a stainless-steel hand auger as specified in Sections 5.1.1.2 and 6.1.1.1 of the SAP. Collected soil samples will be screened using a photoionization detector (PID) in accordance with Section 6.8.3 of the SAP. Surface soil samples will be screened for information purposes only, not to aid in the selection of samples for analysis. Sample containers, sample volumes, preservatives, and holding times for the analyses required in this RI SFSP are discussed in Section 4.0 and listed in Table 4-1 of the QAP. Sample documentation and COC will be recorded as specified in Chapter 6.0 of the SAP. The samples will be analyzed for the parameters listed in Section 4.6 of this RI SFSP. Ten surface soil samples will be analyzed for VOCs, SVOCs, metals, explosives, pesticides, herbicides, and polychlorinated biphenyls (PCB) and the remaining ten surface soil samples will be analyzed for metals and explosives only.

4.3.2 Subsurface Soil Sampling

Thirty subsurface soil samples will be collected at the 15 soil boring locations proposed at Parcel 137Q-X. Two discrete subsurface soil samples will be collected from each soil boring. Section 4.3.2.2 describes the procedure for selecting the subsurface soil sample interval by XRF screening.

The upper subsurface sample at proposed soil boring location HR-137Q-GP14 will be collected at the depth (1 to 2 feet bgs) to match the subsurface soil sample collected at location HR-137Q-GP04 during the SI to confirm contamination levels summarized in Table 2-5. This proposed subsurface sample location is described in Table 4-2. The lower subsurface soil sample from each soil boring will be collected from an interval based on the XRF screening but not any deeper than 12 feet bgs.

Table 4-4

Surface Soil and Subsurface Soil Sample Designations and QA/QC Sample Quantities
Former 81mm Mortar Range, Parcel 137Q-X
Remedial Investigation
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Designation	Sample Depth (feet)	QA/QC Samples		Analytical Suite
			Field Duplicates	MS/MSD	
HR-137Q-GP12	HR-137Q-GP12-SS-RH0041-REG HR-137Q-GP12-DS-RH0042-REG HR-137Q-GP12-DS-RH0043-REG	0-1 1-12 1-12[b]		HR-137Q-GP12-SS-RH0041-MS/MSD	TCL VOCs, TCL SVOCs, TAL Metals, and Nitroaromatic/Nitramine Explosives, Pesticides, Herbicides and PCB's
HR-137Q-GP13	HR-137Q-GP13-SS-RH0044-REG HR-137Q-GP13-DS-RH0045-REG HR-137Q-GP13-DS-RH0047-REG	0-1 1-12 1-12[b]	HR-137Q-GP13-DS-RH0046-FD		TCL VOCs, TCL SVOCs, TAL Metals, and Nitroaromatic/Nitramine Explosives, Pesticides, Herbicides and PCB's
HR-137Q-GP14	HR-137Q-GP14-SS-RH0048-REG HR-137Q-GP14-DS-RH0049-REG HR-137Q-GP14-DS-RH0050-REG	0-1 1-2[a] 2-12[b]			TCL VOCs, TCL SVOCs, TAL Metals, and Nitroaromatic/Nitramine Explosives, Pesticides, Herbicides and PCB's
HR-137Q-GP15	HR-137Q-GP15-SS-RH0051-REG HR-137Q-GP15-DS-RH0052-REG HR-137Q-GP15-DS-RH0053-REG	0-1 1-12 1-12[b]			TCL VOCs, TCL SVOCs, TAL Metals, and Nitroaromatic/Nitramine Explosives, Pesticides, Herbicides and PCB's
HR-137Q-GP16	HR-137Q-GP16-SS-RH0054-REG HR-137Q-GP16-DS-RH0055-REG HR-137Q-GP16-DS-RH0056-REG	0-1 1-12 1-12[b]			TCL VOCs, TCL SVOCs, TAL Metals, and Nitroaromatic/Nitramine Explosives, Pesticides, Herbicides and PCB's
HR-137Q-GP17	HR-137Q-GP17-SS-RH0057-REG HR-137Q-GP17-DS-RH0058-REG HR-137Q-GP17-DS-RH0059-REG	0-1 1-12 1-12[b]			TAL Metals and Nitroaromatic/Nitramine Explosives
HR-137Q-GP18	HR-137Q-GP18-SS-RH0060-REG HR-137Q-GP18-DS-RH0061-REG HR-137Q-GP18-DS-RH0062-REG	0-1 1-12 1-12[b]			TAL Metals and Nitroaromatic/Nitramine Explosives
HR-137Q-GP19	HR-137Q-GP19-SS-RH0063-REG HR-137Q-GP19-DS-RH0064-REG HR-137Q-GP19-DS-RH0065-REG	0-1 1-12 1-12[b]	HR-137Q-GP19-DS-RH0066-FD		TAL Metals and Nitroaromatic/Nitramine Explosives
HR-137Q-GP20	HR-137Q-GP20-SS-RH0067-REG HR-137Q-GP20-DS-RH0068-REG HR-137Q-GP20-DS-RH0069-REG	0-1 1-12 1-12[b]			TAL Metals and Nitroaromatic/Nitramine Explosives
HR-137Q-GP21	HR-137Q-GP21-SS-RH0070-REG HR-137Q-GP21-DS-RH0072-REG HR-137Q-GP21-DS-RH0073-REG	0-1 1-12 1-12[b]	HR-137Q-GP21-SS-RH071-FD		TAL Metals and Nitroaromatic/Nitramine Explosives

Table 4-4

Surface Soil and Subsurface Soil Sample Designations and QA/QC Sample Quantities
Former 81mm Mortar Range, Parcel 137Q-X
Remedial Investigation
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Designation	Sample Depth (feet)	QA/QC Samples		Analytical Suite
			Field Duplicates	MS/MSD	
HR-137Q-GP22	HR-137Q-GP22-SS-RH0074-REG HR-137Q-GP22-DS-RH0075-REG HR-137Q-GP22-DS-RH0076-REG	0-1 1-12 1-12[b]			TAL Metals and Nitroaromatic/Nitramine Explosives
HR-137Q-GP23	HR-137Q-GP23-SS-RH0077-REG HR-137Q-GP23-DS-RH0078-REG HR-137Q-GP23-DS-RH0079-REG	0-1 1-12 1-12[b]		HR-137Q-GP23-DS-RH0078-MS/MSD	TAL Metals and Nitroaromatic/Nitramine Explosives
HR-137Q-GP24	HR-137Q-GP24-SS-RH0080-REG HR-137Q-GP24-DS-RH0081-REG HR-137Q-GP24-DS-RH0082-REG	0-1 1-12 1-12[b]			TAL Metals and Nitroaromatic/Nitramine Explosives
HR-137Q-GP25	HR-137Q-GP25-SS-RH0083-REG HR-137Q-GP25-DS-RH0084-REG HR-137Q-GP25-DS-RH0085-REG	0-1 1-12 1-12[b]			TAL Metals and Nitroaromatic/Nitramine Explosives
HR-137Q-GP26	HR-137Q-GP26-SS-RH0086-REG HR-137Q-GP26-DS-RH0088-REG HR-137Q-GP26-DS-RH0089-REG	0-1 1-12 1-12[b]	HR-137Q-GP26-SS-RH0087-FD		TAL Metals and Nitroaromatic/Nitramine Explosives
HR-137Q-GP27	HR-137Q-GP27-SS-RH0090-REG	0-1			TCL VOCs, TCL SVOCs, TAL Metals, and Nitroaromatic/Nitramine Explosives, Pesticides, Herbicides and PCB's
HR-137Q-GP28	HR-137Q-GP28-SS-RH0091-REG	0-1			TCL VOCs, TCL SVOCs, TAL Metals, and Nitroaromatic/Nitramine Explosives, Pesticides, Herbicides and PCB's
HR-137Q-GP29	HR-137Q-GP29-SS-RH0092-REG	0-1			TCL VOCs, TCL SVOCs, TAL Metals, and Nitroaromatic/Nitramine Explosives, Pesticides, Herbicides and PCB's
HR-137Q-GP30	HR-137Q-GP30-SS-RH0093-REG	0-1			TCL VOCs, TCL SVOCs, TAL Metals, and Nitroaromatic/Nitramine Explosives, Pesticides, Herbicides and PCB's
HR-137Q-GP31	HR-137Q-GP31-SS-RH0094-REG	0-1	HR-137Q-GP19-SS-RH0095-FD		TCL VOCs, TCL SVOCs, TAL Metals, and Nitroaromatic/Nitramine Explosives, Pesticides, Herbicides and PCB's

a First subsurface soil sample in this boring to be collected 1 to 2 feet below ground surface (bgs) to match subsurface sample depth at location HR-137Q-GP04.
b Second subsurface soil sample to be collected from different depth interval than the first subsurface soil sample so as to collect 2 discrete subsurface soil samples.

FD - Field duplicate.
MS/MSD - Matrix spike/matrix spike duplicate.
QA/QC - Quality assurance/quality control.
REG - Field sample.
TAL - Target analyte list.
TCL - Target compound list.
SVOCs - Semivolatile organic compounds.
VOCs - Volatile organic compounds.

4.3.2.1 Sample Locations and Rationale

The sampling rationale for each subsurface soil sample is listed in Table 4-2. Proposed sampling locations are shown in Figure 4-2. Subsurface soil sample designations and QA/QC sample requirements are summarized in Table 4-4. The final soil boring sampling locations will be determined in the field by the on-site geologist based on actual field conditions.

4.3.2.2 Sample Collection

Subsurface soil samples will be collected from soil borings at a depth greater than 1 foot bgs in the unsaturated zone. The soil borings will be advanced and soil samples collected using the direct-push sampling procedures specified in Sections 5.1.1.1 and 6.1.1.1 of the SAP (IT, 2002a). However, in areas where site access does not permit the use of a direct-push rig, the samples will be collected using a hand auger, as specified in Sections 5.1.1.2 and 6.1.1.1 of the SAP.

Soil samples will be collected continuously for the first 12 feet or until either groundwater or refusal is met. A detailed lithogical log will be recorded by the on-site geologist for each borehole. The soil borings will be logged in accordance with American Society for Testing and Materials (ASTM) Method D 2488 using the Unified Soil Classification System (ASTM, 1993). Two subsurface soil samples will be collected from each soil boring at Parcel 137Q-X using either direct-push technology (DPT) or hand auger. XRF will be used in the field to screen the collected depth intervals to determine the subsurface soil samples with the highest lead concentrations, which will be sent to the laboratory for additional analysis. The following describes the sample handling procedure that will be used to screen the subsurface soil intervals.

Whether the boring is installed with DPT or hand auger, the site geologist will describe the soil interval for the boring log and take headspace readings for organic vapors as per the procedures specified in the SAP. The XRF technician will then composite the sample in a decontaminated stainless steel mixing bowl and transfer a representative aliquot for on-site analysis into a labeled disposable aluminum pan. Remaining soil will be transferred temporarily into a labeled Ziploc® bag and stored in a cooler on ice until the boring is complete. The aliquot for on-site analysis will be visually assessed for moisture content and, if the content is too high, the soil will be further prepared by oven drying. If the technician judges the soil is dry enough, the aliquot will be further mixed and hand-tamped using a sampling spoon, the XRF cover plate will be placed over the soil in a way to ensure good contact with the film window. The XRF will be placed over the cover plate and the analysis initiated. The XRF technician will monitor the output from the XRF during sample screening, and after an adequate amount of time has passed to quantify the lead and copper soil concentrations (approximately 120 seconds), the screening will be stopped. The technician will then record the results presented on the XRF liquid crystal display

screen onto the XRF analysis form. This process will be repeated until all collected intervals for a boring have been collected and DPT or auger refusal is encountered.

At that point, the XRF technician and the geologist will confer and review the available data. Intervals will then be selected for off-site analysis based on geological conditions, results of the headspace screening, and the XRF analysis. Selected depth interval samples will be removed from temporary storage in the cooler and aliquots will be collected to fulfill the analytical requirements specified in this SFSP. Site conditions such as lithology may also determine the actual sample depth interval submitted for analysis. The collected subsurface soil samples will be field-screened using a PID in accordance with Section 6.8.3 of the SAP to measure samples exhibiting elevated readings exceeding background (readings in ambient air). Subsurface soil samples will be PID-screened for information purposes only, not to aid in selection of samples for analysis.

Sample documentation and COC will be recorded as specified in Chapter 6.0 of the SAP. Sample containers, sample volumes, preservatives, and holding times for the analyses required in this RI SFSP are discussed in Section 4.0 and listed in Table 4-1 of the QAP. The samples will be analyzed for the parameters listed in Section 4.6 of this RI SFSP. The ten subsurface soil samples from the five selected borings shown on Figure 4-2 will be analyzed for VOCs, SVOCs, metals, explosives, pesticides, herbicides and PCBs. The remaining 20 subsurface soil samples collected from the 10 soil borings to be determined based on XRF screening will be analyzed for metals and explosives only.

4.3.3 Groundwater Sampling

Four groundwater samples will be collected from the four pre-existing permanent monitoring wells at the Former 81mm Mortar Range, Parcel 137Q-X.

4.3.3.1 Sample Locations and Rationale

The existing groundwater monitoring wells are depicted in Figure 4-2. The groundwater sampling rationale is listed in Table 4-2. Groundwater sample data will provide information on groundwater quality in the residuum aquifer. The groundwater sample designations, depths, and required QA/QC sample quantities are listed in Table 4-5.

4.3.3.2 Sample Collection

Prior to sampling monitoring wells, static water levels will be measured from the monitoring wells to be sampled as part of this RI. Groundwater elevations will be used to define the groundwater flow in the residuum saturated zone. Water levels will be measured as outlined in

Table 4-5

Groundwater Sample Designations and QA/QC Sample Quantities
Former 81mm Mortar Range, Parcel 137Q-X
Remedial Investigation
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Designation	Sample Matrix	QA/QC Samples		Analytical Suite
			Field Duplicates	MS/MSD	
HR-137Q-MW01	HR-137Q-MW01-GW-RH3006-REG	Groundwater	HR-137Q-MW01-GW-RH3007-FD		TCL VOCs, TCL SVOCs, TAL Metals, Nitroaromatic/Nitramine Explosives, Herbicides, Pesticides and PCB's
HR-137Q-MW02	HR-137Q-MW02-GW-RH3008-REG	Groundwater		HR-137Q-MW02-GW-RH3008-MS/MSD	TCL VOCs, TCL SVOCs, TAL Metals, Nitroaromatic/Nitramine Explosives, Herbicides, Pesticides and PCB's
HR-137Q-MW03	HR-137Q-MW03-GW-RH3009-REG	Groundwater			TCL VOCs, TCL SVOCs, TAL Metals, Nitroaromatic/Nitramine Explosives, Herbicides, Pesticides and PCB's
HR-137Q-MW04	HR-137Q-MW04-GW-RH3010-REG	Groundwater			TCL VOCs, TCL SVOCs, TAL Metals, Nitroaromatic/Nitramine Explosives, Herbicides, Pesticides and PCB's

FD - Field duplicate.
MS/MSD - Matrix spike/matrix spike duplicate.
QA/QC - Quality assurance/quality control.
REG - Field sample.
TAL - Target analyte list.
TCL - Target compound list.
SVOCs - Semivolatile organic compounds.
VOCs - Volatile organic compounds.

Section 5.5 of the SAP (IT, 2002a). Groundwater samples will be collected in accordance with the procedures outlined in Section 6.1.1.5 and Attachment 5 of the SAP. Low-flow groundwater sampling methodology outlined in Attachment 5 of the SAP may be used as deemed necessary by the IT site manager. Field parameters to be measured at the time of sample collection are detailed in Section 6.3 of the SAP.

Sample documentation and COC will be recorded as specified in Chapter 6.0 of the SAP. Sample containers, sample volumes, preservatives, and holding times for the analyses required in this RI SFSP are discussed in Section 4.0, Table 4-1 of the QAP (IT, 2002a). The samples will be analyzed for the parameters listed in Section 4.6 of this RI SFSP.

4.3.4 Surface Water Sampling

Seven surface water samples will be collected from intermittent streams in the vicinity of the Former 81mm Mortar Range, Parcel 137Q-X.

4.3.4.1 Sample Locations and Rationale

The surface water sampling rationale for each location is listed in Table 4-2. The surface water samples will be collected from the proposed locations on Figure 4-2. The surface water sample designations and required QA/QC sample requirements are listed in Table 4-6. The exact sampling locations will be determined in the field by the ecological sampler, based on drainage pathways and actual field observations.

4.3.4.2 Sample Collection

The surface water samples will be collected in accordance with the procedures specified in Section 6.1.1.3 of the SAP (IT, 2002a). Sample documentation and COC will be recorded as specified in Chapter 6.0 of the SAP. Sample containers, sample volumes, preservatives, and holding times for the analyses required in this SFSP are discussed in Chapter 4.0 and listed in Table 4-2 of the QAP. The samples will be analyzed for the parameters listed in Section 4.6 of this SFSP.

4.3.5 Sediment Sampling

Seven sediment samples will be collected from the same locations as the surface water samples described in Section 4.3.4.

4.3.5.1 Sample Locations and Rationale

The proposed locations for the sediment samples are shown in Figure 4-2. Sediment sampling rationale for each location is presented in Table 4-2. The sediment sample designations and

Table 4-6

Surface Water and Sediment Sample Designations and QA/QC Sample Quantities
Former 81mm Mortar Range, Parcel 137Q-X
Remedial Investigation
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Designation	Sample Matrix	Sample Depth (feet)	QA/QC Samples		Analytical Suite
				Field Duplicates	MS/MSD	
HR-137Q-SW/SD01	HR-137Q-SW/SD01-SW-RH2001-REG	Surface water	N/A			TCL VOCs, TCL SVOCs, TAL Metals, Nitroaromatic/Nitramine Explosives, Pesticides, Herbicides and PCB's. (Also for Sediment - TOC and Grain Size)
	HR-137Q-SW/SD01-SD-RH1001-REG	sediment	0-0.5			
HR-137Q-SW/SD02	HR-137Q-SW/SD02-SW-RH2002-REG	Surface water	N/A	HR-137Q-SW/SD02-SW-RH2003-FD		TCL VOCs, TCL SVOCs, TAL Metals, Nitroaromatic/Nitramine Explosives, Pesticides, Herbicides and PCB's. (Also for Sediment - TOC and Grain Size)
	HR-137Q-SW/SD02-SD-RH1002-REG	sediment	0-0.5	HR-137Q-SW/SD02-SD-RH1003-FD		
HR-137Q-SW/SD03	HR-137Q-SW/SD03-SW-RH2004-REG	Surface water	N/A			TCL VOCs, TCL SVOCs, TAL Metals, Nitroaromatic/Nitramine Explosives, Pesticides, Herbicides and PCB's. (Also for Sediment - TOC and Grain Size)
	HR-137Q-SW/SD03-SD-RH1004-REG	sediment	0-0.5			
HR-137Q-SW/SD04	HR-137Q-SW/SD04-SW-RH2005-REG	Surface water	N/A			TCL VOCs, TCL SVOCs, TAL Metals, Nitroaromatic/Nitramine Explosives, Pesticides, Herbicides and PCB's. (Also for Sediment - TOC and Grain Size)
	HR-137Q-SW/SD04-SD-RH1005-REG	sediment	0-0.5			
HR-137Q-SW/SD05	HR-137Q-SW/SD05-SW-RH2006-REG	Surface water	N/A		HR-137Q-SW/SD05-SW-RH2006-MS/MSD	TCL VOCs, TCL SVOCs, TAL Metals, Nitroaromatic/Nitramine Explosives, Pesticides, Herbicides and PCB's. (Also for Sediment - TOC and Grain Size)
	HR-137Q-SW/SD05-SD-RH1006-REG	sediment	0-0.5		HR-137Q-SW/SD05-SD-RH1006-MS/MSD	
HR-137Q-SW/SD06	HR-137Q-SW/SD06-SW-RH2007-REG	Surface water	N/A			TCL VOCs, TCL SVOCs, TAL Metals, Nitroaromatic/Nitramine Explosives, Pesticides, Herbicides and PCB's. (Also for Sediment - TOC and Grain Size)
	HR-137Q-SW/SD06-SD-RH1007-REG	sediment	0-0.5			
HR-137Q-SW/SD07	HR-137Q-SW/SD07-SW-RH2008-REG	Surface water	N/A			TCL VOCs, TCL SVOCs, TAL Metals, Nitroaromatic/Nitramine Explosives, Pesticides, Herbicides and PCB's. (Also for Sediment - TOC and Grain Size)
	HR-137Q-SW/SD07-SD-RH1008-REG	sediment	0-0.5			

FD - Field duplicate.
MS/MSD - Matrix spike/matrix spike duplicate.
N/A - Not applicable
QA/QC - Quality assurance/quality control.
REG - Field sample.
SVOCs - Semivolatile organic compounds.
TAL - Target analyte list.
TCL - Target compound list.
TOC - Total organic carbon.
VOCs - Volatile organic compounds.

required QA/QC sample requirements are listed in Table 4-6. The actual sediment sample points will be at the discretion of the ecological sampler, based on the drainage pathways and actual field observations.

4.3.5.2 Sample Collection

The sediment samples will be collected in accordance with the procedures specified in Section 6.1.1.2 of the SAP. Sample documentation and COC will be recorded as specified in Chapter 6.0 of the SAP. Sample containers, sample volumes, preservatives, and holding times for the analyses required in this SFSP are discussed in Chapter 4.0 and listed in Table 4-1 of the QAP. The sediment samples will be analyzed for the parameters listed in Section 4.6 of this SFSP.

4.4 Decontamination Requirements

Decontamination will be performed on sampling and nonsampling equipment to prevent cross-contamination between sampling locations. Decontamination of sampling equipment will be performed in accordance with the requirements presented in Section 6.5.1.1 of the SAP (IT, 2002a). Decontamination of nonsampling equipment will be performed in accordance with the requirements presented in Section 6.5.1.2 of the SAP.

4.5 Surveying of Sample Locations

Sampling locations will be marked with pin flags, stakes, and/or flagging and will be surveyed using either GPS or conventional civil survey techniques, as necessary to obtain the required level of accuracy. Horizontal coordinates will be referenced to the U.S. State Plane Coordinate System, Alabama East Zone, North American Datum 1983. Elevations will be referenced to the North American Vertical Datum of 1988.

Horizontal coordinates for soil, sediment, and surface water locations will be recorded using a GPS to provide accuracy within one meter. Any future monitoring wells will be surveyed to an accuracy of 0.1 foot for horizontal coordinates and 0.01 foot for elevations, using survey-grade GPS techniques and/or conventional civil survey techniques, as required. Procedures to be used for GPS surveying are described in Section 4.4.1.1 of the SAP. Conventional land survey requirements are presented in Section 4.4.1.2 of the SAP.

4.6 Analytical Program

Selected samples collected at locations specified in this chapter of this SFSP will be analyzed for specific suites of chemicals and elements based on the history of site usage and previous investigation data, as well as EPA, ADEM, FTMC, and USACE requirements. Definitive target analyses for samples collected from the Former 81mm Mortar Range, Parcel 137Q-X, consist of the following list of analytical suites:

- TCL VOCs - EPA Method 5035/8260B
- TCL SVOCs - EPA Method 8270C
- Target Analyte List metals - EPA Method 6010B/7000
- Nitroaromatic/nitramine explosives - EPA Method 8330
- Chlorinated pesticides - EPA Method 8081A
- Organophosphorus pesticides - EPA Method 8141A
- Chlorinated herbicides - EPA Method 8151A
- PCBs - EPA Method 8082.

In addition, sediment samples will be analyzed for the following parameters:

- Total organic carbon – EPA Method 9060
- Grain size – ASTM D421/D422.

The samples will be analyzed using EPA SW-846 Update III methods where applicable, as presented in Table 4-7 of this RI SFSP and Section 5.0 of the QAP. Data will be reported in accordance with definitive data requirements of Chapter 2 of the USACE Engineer Manual, *Chemical Quality Assurance for Hazardous, Toxic, and Radioactive Waste (HTRW) Projects* (USACE, 1997) and evaluated by the stipulated requirements for the generation of definitive data (Section 7.2.2 of the QAP). Chemical data will be reported via hard-copy data packages by the laboratory using Contract Laboratory Program-like forms, along with electronic copies. These packages will be validated in accordance with EPA National Functional Guidelines by Level III criteria.

4.7 Sample Preservation, Packaging, and Shipping

Sample preservation, packaging, and shipping will follow the procedures specified in Sections 6.1.3 through 6.1.7 of the SAP (IT, 2002a). Completed analysis request/COC records will be secured and included with each shipment of coolers to:

Attention: Sample Receiving/ Elizabeth McIntyre
EMAX Laboratories Inc.
1835 205th Street
Torrence, California 90501
Telephone: (310) 618-8889.

Table 4-7

Analytical Samples for the Remedial Investigation
Former 81mm Mortar Range, Parcel 137Q-X
Fort McClellan, Calhoun County, Alabama

Parameters	Analysis Method	Sample Matrix	TAT Needed	Field Samples			QA/QC Samples[a]				EMAX
				No. of Sample Points	No. of Events	No. of Field Samples	Field Dups (10%)	MS/MSD (5%)	Trip Blank (1/ship)	Eq. Rinse (1/wk/matrix)	Total No. Analysis
Parcel 137Q-X: 11 water matrix samples (4 groundwater and 7 surface water samples) and 57 soil matrix samples (20 surface soil samples, 30 subsurface soil samples, and 7 sediment samples)											
TCL VOCs	8260B	water	normal	11	1	11	2	1	3	1	19
TCL SVOCs	8270C	water	normal	11	1	11	2	1	0	1	16
TAL Metals	6010B/7000	water	normal	11	1	11	2	1	0	1	16
Explosives	8330	water	normal	11	1	11	2	1	0	1	16
Cl Pesticides	8081	water	normal	11	1	11	2	1	0	1	16
Op Pesticides	8141A	water	normal	11	1	11	2	1	0	1	16
Cl Herbicides	8151	water	normal	11	1	11	2	1	0	1	16
PCB's	8082	water	normal	11	1	11	2	1	0	1	16
TCL VOCs	8260B	soil	normal	27	1	27	3	1	0	1	33
TCL SVOCs	8270C	soil	normal	27	1	27	3	1	0	1	33
TAL Metals	6010B/7000	soil	normal	57	1	57	6	1	0	1	66
Explosives	8330	soil	normal	57	1	57	6	1	0	1	66
Cl Pesticides	8081	soil	normal	27	1	27	3	1	0	1	33
Op Pesticides	8141A	soil	normal	27	1	27	3	1	0	1	33
Cl Herbicides	8151	soil	normal	27	1	27	3	1	0	1	33
PCB's	8082	soil	normal	27	1	27	3	1	0	1	33
Also, sediment samples will be analyzed for the following parameters:											
Total Organic Carbon	9060	sediment	normal	7	1	7	3	1	0	1	13
Grain size	ASTM D421/D422	sediment	normal	7	1	7	3	1	0	1	13
Parcel 137Q-X Subtotal:				356			48	16	0	16	452

[a]Field duplicate, QA split, and MS/MSD samples were calculated as a percentage of the field samples collected per site and were rounded to the nearest whole number. Trip blank samples will be collected with water matrix samples for VOC analysis only. Assumed four field samples per day to estimate trip blanks. Equipment blanks will be collected once per event whenever sampling equipment is field decontaminated and re-used. They will be repeated weekly for sampling events that last more than 1 week. Assumed 20 field samples will be collected per week to estimate number of equipment blanks.

Cl - Chlorinated
Explosives - Nitroaromatic and Nitramine.
MS/MSD - Matrix spike/matrix spike duplicate.
Op - Organophosphorus
QA/QC - Quality assurance/quality control.
SVOCs - Semivolatile organic compounds.
TAL - Target analyte list.
TAT - Turn-around time
TCL - Target compound list.
VOCs - Volatile organic compounds.

Ship samples to:
EMAX Laboratories, Inc.
1835 205th Street
Torrance, CA 90501
Attn: Elizabeth McIntyre
Tel: 310-618-8889
Fax: 310-618-0818

4.8 Investigation-Derived Waste Management

Management and disposal of IDW will follow procedures and requirements described in Appendix D of the SAP (IT, 2002a). The IDW expected to be generated at the Former 81mm Mortar Range, Parcel 137Q-X, will include drill cuttings, purge water from permanent monitoring well sampling activities, decontamination fluids, sampling materials, and disposable personal protective equipment. The IDW will be characterized and staged at a secure location designated by the site manager while awaiting final disposal. Sampling of IDW to obtain analytical results for characterizing the waste for disposal will follow the procedures specified in Section 6.1.1.8 of the SAP (IT, 2002a). The cuttings and water shall be containerized per methodology previously established during drilling activities at FTMC.

4.9 Site-Specific Safety and Health

Safety and health requirements for the RI are provided in the SSHP attachment for the Former 81mm Mortar Range, Parcel 137Q-X. The SSHP attachment will be used in conjunction with the installation-wide safety and health plan, Appendix A of the SAP (IT, 2002a), and the site-specific UXO safety plan.

5.0 Project Schedule

The project schedule for the RI activities will be provided by the IT project manager to the BCT.

6.0 References

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ATTACHMENT 1

LIST OF ABBREVIATIONS AND ACRONYMS

List of Abbreviations and Acronyms

2,4-D	2,4-dichlorophenoxyacetic acid
2,4,5-T	2,4,5-trichlorophenoxyacetic acid
2,4,5-TP	2,4,5-trichlorophenoxypropionic acid
3D	3D International Environmental Group
AB	ambient blank
AbB3	Anniston gravelly clay loam, 2 to 6 percent slopes, severely eroded
AbC3	Anniston gravelly clay loam, 6 to 10 percent slopes, severely eroded
AbD3	Anniston and Allen gravelly clay loams, 10 to 15 percent slopes, eroded
ABLM	adult blood lead model
Abs	skin absorption
ABS	dermal absorption factor
AC	hydrogen cyanide
ACAD	AutoCadd
AcB2	Anniston and Allen gravelly loams, 2 to 6 percent slopes, eroded
AcC2	Anniston and Allen gravelly loams, 6 to 10 percent slopes, eroded
AcD2	Anniston and Allen gravelly loams, 10 to 15 percent slopes, eroded
AcE2	Anniston and Allen gravelly loams, 15 to 25 percent slopes, eroded
ACGIH	American Conference of Governmental Industrial Hygienists
AdE	Anniston and Allen stony loam, 10 to 25 percent slope
ADEM	Alabama Department of Environmental Management
ADPH	Alabama Department of Public Health
AEC	U.S. Army Environmental Center
AEDA	ammunition, explosives, and other dangerous articles
AEL	airborne exposure limit
AET	adverse effect threshold
AF	soil-to-skin adherence factor
AHA	ammunition holding area
AL	Alabama
ALARNG	Alabama Army National Guard
ALAD	δ-aminolevulinic acid dehydratase
ALDOT	Alabama Department of Transportation
amb.	amber
amsl	above mean sea level
ANAD	Anniston Army Depot
AOC	area of concern
AP	armor piercing
APEC	areas of potential ecological concern
APT	armor-piercing tracer
AR	analysis request
ARAR	applicable or relevant and appropriate requirement
AREE	area requiring environmental evaluation
AS/SVE	air sparging/soil vapor extraction
ASP	Ammunition Supply Point
ASR	Archives Search Report
AST	aboveground storage tank
ASTM	American Society for Testing and Materials
AT	averaging time
atm-m^3/mol	atmospheres per cubic meter per mole
ATSDR	Agency for Toxic Substances and Disease Registry
ATV	all-terrain vehicle
AUF	area use factor
AWARE	Associated Water and Air Resources Engineers, Inc.
AWQC	ambient water quality criteria
AWWSB	Anniston Water Works and Sewer Board
‘B’	Analyte detected in laboratory or field blank at concentration greater than the reporting limit (and greater than zero)
BCF	blank correction factor; bioconcentration factor
BCT	BRAC Cleanup Team
BERA	baseline ecological risk assessment
BEHP	bis(2-ethylhexyl)phthalate
BFB	bromofluorobenzene
BFE	base flood elevation
BG	Bacillus globigii
BGR	Bains Gap Road
bgs	below ground surface
BHC	hexachlorocyclohexane
BHHRA	baseline human health risk assessment
BIRTC	Branch Immaterial Replacement Training Center
bkg	background
bls	below land surface
BOD	biological oxygen demand
Bp	soil-to-plant biotransfer factors
BRAC	Base Realignment and Closure
Braun	Braun Intertec Corporation
BSAF	biota-to-sediment accumulation factors
BSC	background screening criterion
BTAG	Biological Technical Assistance Group
BTEX	benzene, toluene, ethyl benzene, and xylenes
BTOC	below top of casing
BTV	background threshold value
BW	biological warfare; body weight
BZ	breathing zone; 3-quinuclidinyl benzilate
C	ceiling limit value
Ca	carcinogen
$CaCO_3$	calcium carbonate
CAA	Clean Air Act
CAB	chemical warfare agent breakdown products
CACM	Chemical Agent Contaminated Media
CAMU	corrective action management unit
CBR	chemical, biological, and radiological
CCAL	continuing calibration
CCB	continuing calibration blank
CCV	continuing calibration verification
CD	compact disc
CDTF	Chemical Defense Training Facility
CEHNC	U.S. Army Engineering and Support Center, Huntsville
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERFA	Community Environmental Response Facilitation Act
CESAS	Corps of Engineers South Atlantic Savannah
CF	conversion factor
CFC	chlorofluorocarbon
CFDP	Center for Domestic Preparedness
CFR	Code of Federal Regulations
CG	phosgene (carbonyl chloride)
CGI	combustible gas indicator
ch	inorganic clays of high plasticity
CHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
CIH	Certified Industrial Hygienist
CK	cyanogen chloride
cl	inorganic clays of low to medium plasticity
Cl	chlorinated
CLP	Contract Laboratory Program
cm	centimeter
CN	chloroacetophenone
CNB	chloroacetophenone, benzene, and carbon tetrachloride
CNS	chloroacetophenone, chloropicrin, and chloroform
CO	carbon monoxide
CO_2	carbon dioxide
Co-60	cobalt-60
CoA	Code of Alabama
COC	chain of custody; chemical of concern
COE	Corps of Engineers
Con	skin or eye contact
COPC	chemical of potential concern
COPEC	constituent of potential ecological concern
CPOM	coarse particulate organic matter
CPSS	chemicals present in site samples
CQCSM	Contract Quality Control System Manager
CRDL	contract-required detection limit
CRL	certified reporting limit
CRQL	contract-required quantitation limit
CRZ	contamination reduction zone
Cs-137	cesium-137
CS	ortho-chlorobenzylidene-malononitrile
CSEM	conceptual site exposure model
CSM	conceptual site model
CT	central tendency
ctr.	container
CWA	chemical warfare agent; Clean Water Act
CWM	chemical warfare material; clear, wide mouth
CX	dichloroformoxime
‘D’	duplicate; dilution
D&I	detection and identification
DAAMS	depot area agent monitoring station

List of Abbreviations and Acronyms *(Continued)*

DAF	dilution-attenuation factor
DANC	decontamination agent, non-corrosive
ºC	degrees Celsius
ºF	degrees Fahrenheit
DCA	dichloroethane
DCE	dichloroethene
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethene
DDT	dichlorodiphenyltrichloroethane
DEH	Directorate of Engineering and Housing
DEHP	di(2-ethylhexyl)phthalate
DEP	depositional soil
DFTPP	decafluorotriphenylphosphine
DI	deionized
DID	data item description
DIMP	di-isopropylmethylphosphonate
DM	dry matter; adamsite
DMBA	dimethylbenz(a)anthracene
DMMP	dimethylmethylphosphonate
DNAPL	dense nonaqueous-phase liquid
DO	dissolved oxygen
DOD	U.S. Department of Defense
DOJ	U.S. Department of Justice
DOT	U.S. Department of Transportation
DP	direct-push
DPDO	Defense Property Disposal Office
DPT	direct-push technology
DQO	data quality objective
DRMO	Defense Reutilization and Marketing Office
DRO	diesel range organics
DS	deep (subsurface) soil
DS2	Decontamination Solution Number 2
DSERTS	Defense Site Environmental Restoration Tracking System
DWEL	drinking water equivalent level
E&E	Ecology and Environment, Inc.
EB	equipment blank
EBS	environmental baseline survey
EC_{20}	effects concentration for 20 percent of a test population
EC_{50}	effects concentration for 50 percent of a test population
ECBC	Edgewood Chemical Biological Center
ED	exposure duration
EDD	electronic data deliverable
EF	exposure frequency
EDQL	ecological data quality level
EE/CA	engineering evaluation and cost analysis
Elev.	elevation
EM	electromagnetic
EMI	Environmental Management Inc.
EM31	Geonics Limited EM31 Terrain Conductivity Meter
EM61	Geonics Limited EM61 High-Resolution Metal Detector
EOD	explosive ordnance disposal
EODT	explosive ordnance disposal team
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
EPIC	Environmental Photographic Interpretation Center
EPRI	Electrical Power Research Institute
EPT	Ephemeroptera, Plecoptera, Trichoptera
ER	equipment rinsate
ERA	ecological risk assessment
ER-L	effects range-low
ER-M	effects range-medium
ESE	Environmental Science and Engineering, Inc.
ESL	ecological screening level
ESMP	Endangered Species Management Plan
ESN	Environmental Services Network, Inc.
ESV	ecological screening value
ET	exposure time
EU	exposure unit
Exp.	Explosives
EXTOXNET	Extension Toxicology Network
E-W	east to west
EZ	exclusion zone
FAR	Federal Acquisition Regulations
FB	field blank
FBI	Family Biotic Index
FD	field duplicate
FDC	Former Decontamination Complex
FDA	U.S. Food and Drug Administration
Fe^{+3}	ferric iron
Fe^{+2}	ferrous iron
FedEx	Federal Express, Inc.
FEMA	Federal Emergency Management Agency
FFCA	Federal Facilities Compliance Act
FFE	field flame expedient
FFS	focused feasibility study
FI	fraction of exposure
Fil	filtered
Flt	filtered
FMDC	Fort McClellan Development Commission
FML	flexible membrane liner
f_{oc}	fraction organic carbon
FOMRA	Former Ordnance Motor Repair Area
FOST	Finding of Suitability to Transfer
Foster Wheeler	Foster Wheeler Environmental Corporation
FR	Federal Register
Frtn	fraction
FS	field split; feasibility study
FSP	field sampling plan
ft	feet
ft/day	feet per day
ft/ft	feet per foot
ft/yr	feet per year
FTA	Fire Training Area
FTMC	Fort McClellan
FTRRA	FTMC Reuse & Redevelopment Authority
g	gram
g/m^3	gram per cubic meter
G-856	Geometrics, Inc. G-856 magnetometer
G-858G	Geometrics, Inc. G-858G magnetic gradiometer
GAF	gastrointestinal absorption factor
gal	gallon
gal/min	gallons per minute
GB	sarin (isopropyl methylphosphonofluoridate)
gc	clay gravels; gravel-sand-clay mixtures
GC	gas chromatograph
GCL	geosynthetic clay liner
GC/MS	gas chromatograph/mass spectrometer
GCR	geosynthetic clay liner
GFAA	graphite furnace atomic absorption
GIS	Geographic Information System
gm	silty gravels; gravel-sand-silt mixtures
gp	poorly graded gravels; gravel-sand mixtures
gpm	gallons per minute
GPR	ground-penetrating radar
GPS	global positioning system
GRA	general response action
GS	ground scar
GSA	General Services Administration; Geologic Survey of Alabama
GSBP	Ground Scar Boiler Plant
GSSI	Geophysical Survey Systems, Inc.
GST	ground stain
GW	groundwater
gw	well-graded gravels; gravel-sand mixtures
H&S	health and safety
HA	hand auger
HC	mixture of hexachloroethane, aluminum powder, and zinc oxide (smoke producer)
HCl	hydrochloric acid
HD	distilled mustard (bis-[dichloroethyl]sulfide)
HDPE	high-density polyethylene
HE	high explosive
HEAST	Health Effects Assessment Summary Tables
Herb.	herbicides
HHRA	human health risk assessment
HI	hazard index

H_2O_2	hydrogen peroxide
HPLC	high-performance liquid chromatography
HNO_3	nitric acid
HQ	hazard quotient
HQ_{screen}	screening-level hazard quotient
hr	hour
HRC	hydrogen releasing compound
HSA	hollow-stem auger
HSDB	Hazardous Substance Data Bank
HTRW	hazardous, toxic, and radioactive waste
'I'	out of control, data rejected due to low recovery
IASPOW	Impact Area South of POW Training Facility
IATA	International Air Transport Authority
ICAL	initial calibration
ICB	initial calibration blank
ICP	inductively-coupled plasma
ICRP	International Commission on Radiological Protection
ICS	interference check sample
ID	inside diameter
IDL	instrument detection limit
IDLH	immediately dangerous to life or health
IDM	investigative-derived media
IDW	investigation-derived waste
IEUBK	Integrated Exposure Uptake Biokinetic
IF	ingestion factor; inhalation factor
ILCR	incremental lifetime cancer risk
IMPA	isopropylmethyl phosphonic acid
IMR	Iron Mountain Road
in.	inch
Ing	ingestion
Inh	inhalation
IP	ionization potential
IPS	International Pipe Standard
IR	ingestion rate
IRDMIS	Installation Restoration Data Management Information System
IRIS	Integrated Risk Information Service
IRP	Installation Restoration Program
IS	internal standard
ISCP	Installation Spill Contingency Plan
IT	IT Corporation
ITEMS	IT Environmental Management System™
'J'	estimated concentration
JeB2	Jefferson gravelly fine sandy loam, 2 to 6 percent slopes, eroded
JeC2	Jefferson gravelly fine sandy loam, 6 to 10 percent slopes, eroded
JfB	Jefferson stony fine sandy loam, 0 to 10 percent slopes have strong slopes
JPA	Joint Powers Authority
K	conductivity
K_d	soil-water distribution coefficient
kg	kilogram
KeV	kilo electron volt
K_{oc}	organic carbon partioning coefficient
K_{ow}	octonal-water partition coefficient
$KMnO_4$	potassium permanganate
L	liter; Lewisite (dichloro-[2-chloroethyl]sulfide)
L/kg/day	liters per kilogram per day
l	liter
LAW	light anti-tank weapon
lb	pound
LBP	lead-based paint
LC	liquid chromatography
LCS	laboratory control sample
LC_{50}	lethal concentration for 50 percent population tested
LD_{50}	lethal dose for 50 percent population tested
LEL	lower explosive limit
LOAEL	lowest-observed-advserse-effects-level
LOEC	lowest-observable-effect-concentration
LRA	land redevelopment authority
LT	less than the certified reporting limit
LUC	land-use control
LUCAP	land-use control assurance plan
LUCIP	land-use control implementation plan
max	maximum
MB	method blank
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MCPA	4-chloro-2-methylphenoxyacetic acid
MCPP	2-(2-methyl-4-chlorophenoxy)propionic acid
MCS	media cleanup standard
MD	matrix duplicate
MDC	maximum detected concentration
MDCC	maximum detected constituent concentration
MDL	method detection limit
mg	milligrams
mg/kg	milligrams per kilogram
mg/kg/day	milligram per kilogram per day
mg/kgbw/day	milligrams per kilogram of body weight per day
mg/L	milligrams per liter
mg/m^3	milligrams per cubic meter
mh	inorganic silts, micaceous or diatomaceous fine, sandy or silt soils
MHz	megahertz
µg/g	micrograms per gram
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
µmhos/cm	micromhos per centimeter
MeV	mega electron volt
min	minimum
MINICAMS	miniature continuous air monitoring system
ml	inorganic silts and very fine sands
mL	milliliter
mm	millimeter
MM	mounded material
MMBtu/hr	million Btu per hour
MNA	monitored natural attenuation
MnO_4-	permanganate ion
MOA	Memorandum of Agreement
MOGAS	motor vehicle gasoline
MOUT	Military Operations in Urban Terrain
MP	Military Police
MPA	methyl phosphonic acid
MPC	maximum permissible concentration
MPM	most probable munition
MQL	method quantitation limit
MR	molasses residue
MRL	method reporting limit
MS	matrix spike
mS/cm	millisiemens per centimeter
mS/m	millisiemens per meter
MSD	matrix spike duplicate
MTBE	methyl tertiary butyl ether
msl	mean sea level
MtD3	Montevallo shaly, silty clay loam, 10 to 40 percent slopes , severely eroded
mV	millivolts
MW	monitoring well
MWI&MP	Monitoring Well Installation and Management Plan
Na	sodium
NA	not applicable; not available
NAD	North American Datum
NAD83	North American Datum of 1983
$NaMnO_4$	sodium permanganate
NAVD88	North American Vertical Datum of 1988
NAS	National Academy of Sciences
NCEA	National Center for Environmental Assessment
NCP	National Contingency Plan
NCRP	National Council on Radiation Protection and Measurements
ND	not detected
NE	no evidence; northeast
ne	not evaluated
NEW	net explosive weight
NFA	No Further Action
NG	National Guard
NGP	National Guardsperson
ng/L	nanograms per liter
NGVD	National Geodetic Vertical Datum
Ni	nickel

NIC	notice of intended change
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
NLM	National Library of Medicine
NO_3^-	nitrate
NOEC	no-observable-effect-concentration
NPDES	National Pollutant Discharge Elimination System
NPW	net present worth
No.	number
NOAA	National Oceanic and Atmospheric Administration
NOAEL	no-observed-adverse-effects-level
NR	not requested; not recorded; no risk
NRC	National Research Council
NRCC	National Research Council of Canada
NRHP	National Register of Historic Places
NRT	near real time
ns	nanosecond
N-S	north to south
NS	not surveyed
NSA	New South Associates, Inc.
nT	nanotesla
nT/m	nanoteslas per meter
NTU	nephelometric turbidity unit
nv	not validated
O_2	oxygen
O_3	ozone
O&G	oil and grease
O&M	operation and maintenance
OB/OD	open burning/open detonation
OD	outside diameter
OE	ordnance and explosives
oh	organic clays of medium to high plasticity
OH•	hydroxyl radical
ol	organic silts and organic silty clays of low plasticity
OP	organophosphorus
ORC	Oxygen Releasing Compound
ORP	oxidation-reduction potential
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
OVM-PID/FID	organic vapor meter-photoionization detector/flame ionization detector
OWS	oil/water separator
oz	ounce
PA	preliminary assessment
PAH	polynuclear aromatic hydrocarbon
PARCCS	precision, accuracy, representativeness, comparability, completeness, and sensitivity
Parsons	Parsons Engineering Science, Inc.
Pb	lead
PBMS	performance-based measurement system
PC	permeability coefficient
PCB	polychlorinated biphenyl
PCDD	polychlorinated dibenzo-p-dioxins
PCDF	polychlorinated dibenzofurans
PCE	perchloroethene
PCP	pentachlorophenol
PDS	Personnel Decontamination Station
PEF	particulate emission factor
PEL	permissible exposure limit
PERA	preliminary ecological risk assessment
PERC	perchloroethene
PES	potential explosive site
Pest.	pesticides
PETN	pentaerythritoltetranitrate
PFT	portable flamethrower
PG	professional geologist
PID	photoionization detector
PkA	Philo and Stendal soils local alluvium, 0 to 2 percent slopes
PM	project manager
POC	point of contact
POL	petroleum, oils, and lubricants
POTW	publicly owned treatment works
POW	prisoner of war
PP	peristaltic pump; Proposed Plan
ppb	parts per billion
ppbv	parts per billion by volume
PPE	personal protective equipment
ppm	parts per million
PPMP	Print Plant Motor Pool
ppt	parts per thousand
PR	potential risk
PRA	preliminary risk assessment
PRG	preliminary remediation goal
PS	chloropicrin
PSSC	potential site-specific chemical
pt	peat or other highly organic silts
PVC	polyvinyl chloride
QA	quality assurance
QA/QC	quality assurance/quality control
QAM	quality assurance manual
QAO	quality assurance officer
QAP	installation-wide quality assurance plan
QC	quality control
QST	QST Environmental, Inc.
qty	quantity
Qual	qualifier
R	rejected data; resample; retardation factor
R&A	relevant and appropriate
RA	remedial action
RAO	remedial action objective
RBC	risk-based concentration; red blood cell
RBRG	risk-based remedial goal
RCRA	Resource Conservation and Recovery Act
RCWM	Recovered Chemical Warfare Material
RD	remedial design
RDX	cyclotrimethylenetrinitramine
ReB3	Rarden silty clay loams
REG	regular field sample
REL	recommended exposure limit
RFA	request for analysis
RfC	reference concentration
RfD	reference dose
RGO	remedial goal option
RI	remedial investigation
RL	reporting limit
RME	reasonable maximum exposure
ROD	Record of Decision
RPD	relative percent difference
RR	range residue
RRF	relative response factor
RRSE	Relative Risk Site Evaluation
RSD	relative standard deviation
RTC	Recruiting Training Center
RTECS	Registry of Toxic Effects of Chemical Substances
RTK	real-time kinematic
RWIMR	Ranges West of Iron Mountain Road
SA	exposed skin surface area
SAD	South Atlantic Division
SAE	Society of Automotive Engineers
SAIC	Science Applications International Corporation
SAP	installation-wide sampling and analysis plan
SARA	Superfund Amendments and Reauthorization Act
sc	clayey sands; sand-clay mixtures
Sch.	schedule
SCM	site conceptual model
SD	sediment
SDG	sample delivery group
SDWA	Safe Drinking Water Act
SDZ	safe distance zone; surface danger zone
SEMS	Southern Environmental Management & Specialties, Inc.
SF	cancer slope factor
SFSP	site-specific field sampling plan
SGF	standard grade fuels
Shaw	Shaw Environmental, Inc.
SHP	installation-wide safety and health plan
SI	site investigation

List of Abbreviations and Acronyms *(Continued)*

SINA	Special Interest Natural Area
SL	standing liquid
SLERA	screening-level ecological risk assessment
sm	silty sands; sand-silt mixtures
SM	Serratia marcescens
SMDP	Scientific Management Decision Point
s/n	signal-to-noise ratio
SO_4^{-2}	sulfate
SOD	soil oxidant demand
SOP	standard operating procedure
SOPQAM	U.S. EPA's *Standard Operating Procedure/Quality Assurance Manual*
sp	poorly graded sands; gravelly sands
SP	submersible pump
SPCC	system performance calibration compound
SPCS	State Plane Coordinate System
SPM	sample planning module
SQRT	screening quick reference tables
Sr-90	strontium-90
SRA	streamlined human health risk assessment
SRI	supplemental remedial investigation
SRM	standard reference material
Ss	stony rough land, sandstone series
SS	surface soil
SSC	site-specific chemical
SSHO	site safety and health officer
SSHP	site-specific safety and health plan
SSL	soil screening level
SSSL	site-specific screening level
SSSSL	site-specific soil screening level
STB	supertropical bleach
STC	source-term concentration
STD	standard deviation
STEL	short-term exposure limit
STL	Severn-Trent Laboratories
STOLS	Surface Towed Ordnance Locator System®
Std. units	standard units
SU	standard unit
SUXOS	senior UXO supervisor
SVOC	semivolatile organic compound
SW	surface water
SW-846	U.S. EPA's *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*
SWMU	solid waste management unit
SWPP	storm water pollution prevention plan
SZ	support zone
TAL	target analyte list
TAT	turn around time
TB	trip blank
TBC	to be considered
TCA	trichloroethane
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TCDF	tetrachlorodibenzofurans
TCE	trichloroethene
TCL	target compound list
TCLP	toxicity characteristic leaching procedure
TDEC	Tennessee Department of Environment and Conservation
TDGCL	thiodiglycol
TDGCLA	thiodiglycol chloroacetic acid
TEA	triethylaluminum
Tetryl	trinitrophenylmethylnitramine
TERC	Total Environmental Restoration Contract
THI	target hazard index
TIC	tentatively identified compound
TLV	threshold limit value
TN	Tennessee
TNB	trinitrobenzene
TNT	trinitrotoluene
TOC	top of casing; total organic carbon
TPH	total petroleum hydrocarbons
TR	target cancer risk
TRADOC	U.S. Army Training and Doctrine Command
TRPH	total recoverable petroleum hydrocarbons
TRV	toxicity reference value
TSCA	Toxic Substances Control Act
TSDF	treatment, storage, and disposal facility
TWA	time-weighted average
UCL	upper confidence limit
UCR	upper certified range
'U'	not detected above reporting limit
UIC	underground injection control
UF	uncertainty factor
URF	unit risk factor
USACE	U.S. Army Corps of Engineers
USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
USAEC	U.S. Army Environmental Center
USAEHA	U.S. Army Environmental Hygiene Agency
USACMLS	U.S. Army Chemical School
USAMPS	U.S. Army Military Police School
USATCES	U.S. Army Technical Center for Explosive Safety
USATEU	U.S. Army Technical Escort Unit
USATHAMA	U.S. Army Toxic and Hazardous Material Agency
USC	United States Code
USCS	Unified Soil Classification System
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	underground storage tank
UTL	upper tolerance level; upper tolerance limit
UXO	unexploded ordnance
UXOQCS	UXO Quality Control Supervisor
UXOSO	UXO safety officer
V	vanadium
VC	vinyl chloride
VOA	volatile organic analyte
VOC	volatile organic compound
VOH	volatile organic hydrocarbon
VQlfr	validation qualifier
VQual	validation qualifier
VX	nerve agent (O-ethyl-S-[diisopropylaminoethyl]-methylphosphonothiolate)
WAC	Women's Army Corps
Weston	Roy F. Weston, Inc.
WP	installation-wide work plan
WRS	Wilcoxon rank sum
WS	watershed
WSA	Watershed Screening Assessment
WWI	World War I
WWII	World War II
XRF	x-ray fluorescence
yd^3	cubic yards